Calculations Using Concentration.

We use the molar mass as a conversion factor in calculations between mass and moles. This is because molar mass is a ratio between mass and moles. Concentration is a ratio between the amount of solute and the amount of solution. So we can use concentration as a conversion factor between these properties in the same way we use molar mass.

Example #1: How many grams of glucose are there in 500 mL of a 2.0% (w/v) glucose solution.

$\frac{2\text{ g}}{100\text{ mL}}$, $\frac{100\text{ mL}}{2\text{ g}}$.

$$\text{amount of solute} = 500\text{ mL} \times \frac{2\text{ g}}{100\text{ mL}}$$

$$= 10\text{ g}$$

∴ the solution contains 10 g of glucose.

Example #2: What volume of solution contains 1.0 g of sodium chloride if the solution concentration is 2.0% (w/v) of NaCl?

$$\text{amount of solution} = 1.0\,\text{g} \times \frac{100\,\text{mL}}{2\,\text{g}} = 50\,\text{mL}$$

$\frac{2\,\text{g}}{100\,\text{mL}}$, $\frac{100\,\text{mL}}{2\,\text{g}}$

∴ the volume is 50 mL.

Example #3: What amount of sodium hydroxide, in moles, is present in 1.00 L of a solution with a concentration of 0.25 mol/L?

$\frac{0.25\ mol}{1\ L}$, $\frac{1\ L}{0.25\ mol}$

$$n = 1.00\ \cancel{L} \times \frac{0.25\ mol}{1\ \cancel{L}} = 0.25\ mol.$$

∴ the amount of NaOH is 0.25 mol

Example #4: What volume of solution with a concentration of 0.20 mol/L can be prepared from 4.0 g of NaOH?

$$M_{NaOH} = 22.99\ g/mol + 16.00\ g/mol + 1.01\ g/mol$$
$$= 40.00\ g/mol.$$

$$n_{NaOH} = 4.0\ g \times \frac{1\ mol}{40.00\ g} = 0.10\ mol$$

$$V = 0.10\ mol \times \frac{1\ L}{0.20\ mol} = 0.5\ L$$

∴ the volume of the solution is 0.5 L.

P 130 P 8, 9

P 131 P 12, 13, 14, 15